

C. WILLIAMSON.
APPARATUS FOR SUBMARINE WORK.

APPLICATION FILED MAR. 13, 1903.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.

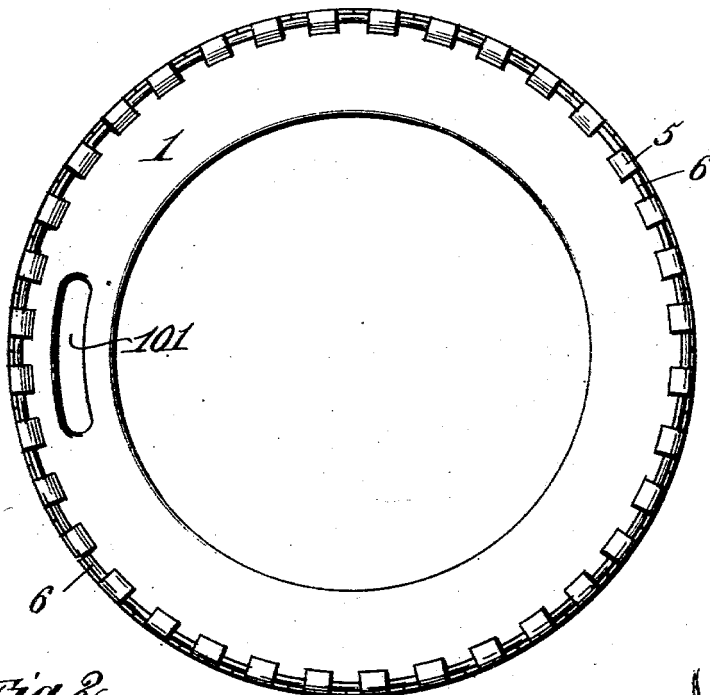
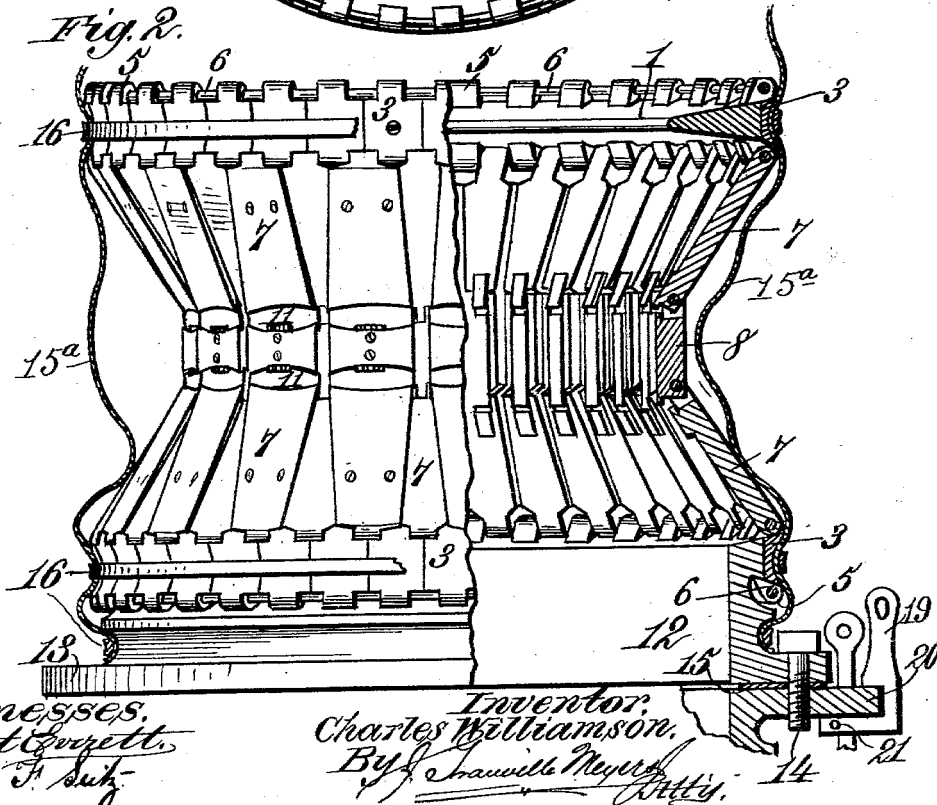


Fig. 2.



Witnesses,
Robert G. Bennett,
Hattie J. Smith.

Inventor,
Charles Williamson.
 By *J. Brauville Meyer,*
Att'y.

C. WILLIAMSON.
APPARATUS FOR SUBMARINE WORK.
APPLICATION FILED MAR. 13, 1903.

NO MODEL.

3 SHEETS—SHEET 2.

Fig. 3.

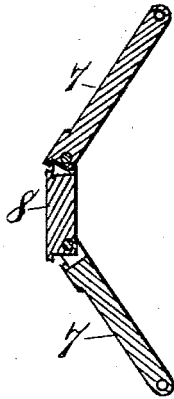


Fig. 4.

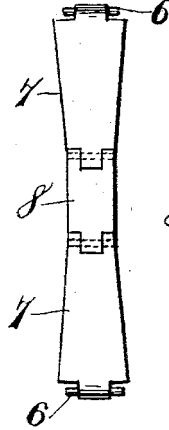


Fig. 5.

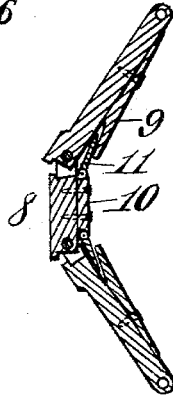


Fig. 6.

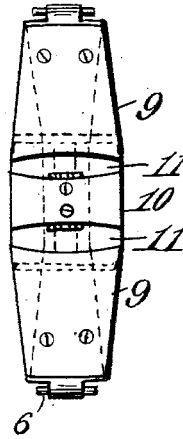


Fig. 7.

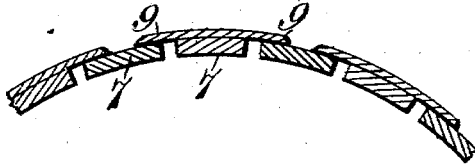


Fig. 9.

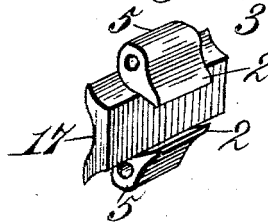


Fig. 8.

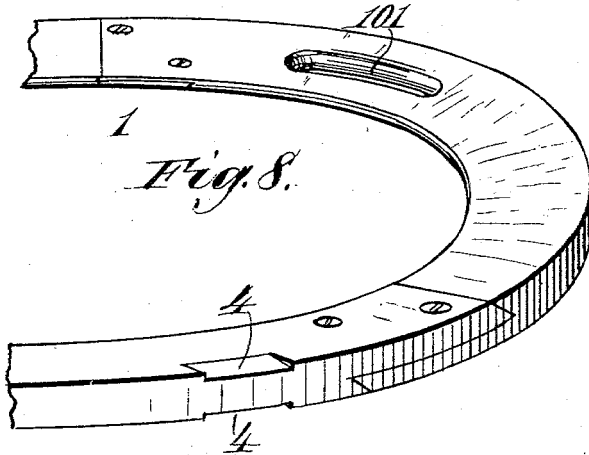
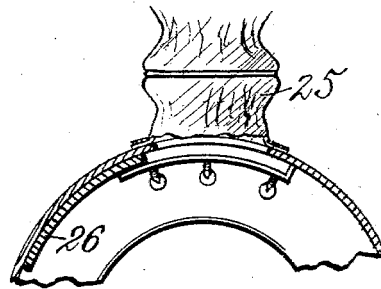


Fig. 12.



Witnesses:
Robert Emmett,
Kattie F. Seitz.

Inventor:
Charles Williamson,
By J. Inawille Meyer
Att'y.

C. WILLIAMSON.
APPARATUS FOR SUBMARINE WORK.

APPLICATION FILED MAR. 13, 1903.

NO MODEL.

3 SHEETS—SHEET 3.

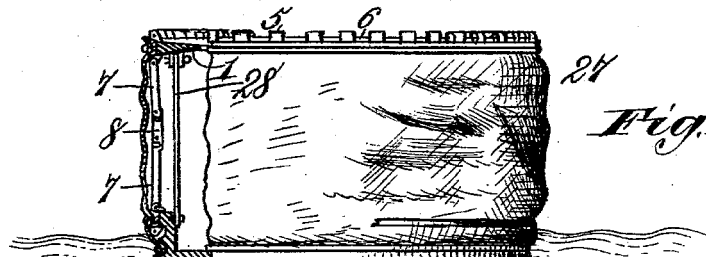


Fig. 10.

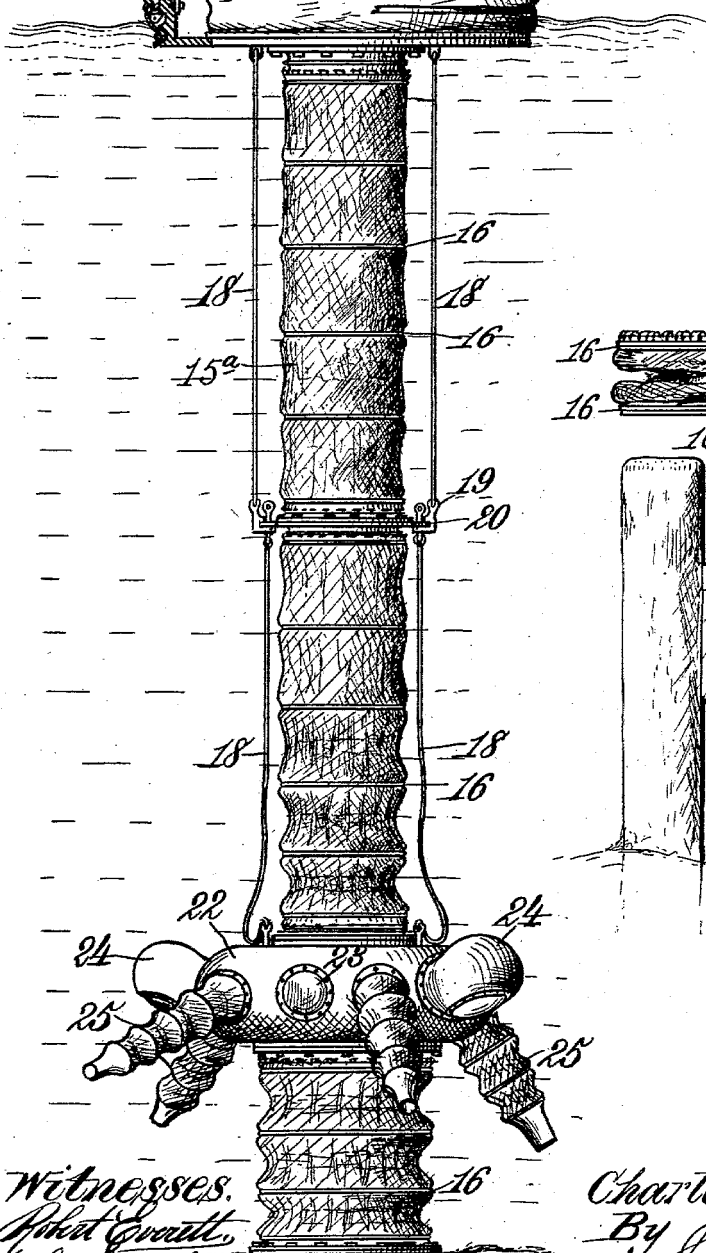


Fig. 11.

Witnesses.
Robert Everett
Hattie F. Subz

Inventor:
Charles Williamson.
 By *J. Sawille Meyer*
Att'y.

UNITED STATES PATENT OFFICE.

CHARLES WILLIAMSON, OF NEWPORT NEWS, VIRGINIA.

APPARATUS FOR SUBMARINE WORK.

SPECIFICATION forming part of Letters Patent No. 745,469, dated December 1, 1903.

Application filed March 13, 1903. Serial No. 147,614. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WILLIAMSON, a citizen of the United States, residing at Newport News, in the county of Warwick and State of Virginia, have invented new and useful Improvements in Apparatus for Submarine Work, of which the following is a specification.

The present invention relates to apparatus for general submarine work, and comprises, generally speaking, a sectional collapsible water-tight tube or caisson which is of such construction that it may be made in readily-separable and easily-assembled parts, which may be packed and shipped to the scene of operations and there be put together by any person of ordinary intelligence and mechanical ability, which is of such character as to be buoyant when placed upon the water, but which will automatically submerge when the tube is being built up and sunk into position for work, and which as the tube descends and the hydrostatic pressure on the sides thereof increases will automatically collapse or close in proportion to the pressure, thereby affording an increased structural resistance to lateral pressure, all as will hereinafter more fully appear. The frame of the tube, which is of iron, has as its essential features a series of rings, preferably circular, as shown, to which are detachably secured hinge-blocks, and to the hinge-blocks and those of the next adjacent similar rings are attached at their opposite ends three-piece folding links, which form the wall of the said collapsible sections, each alternate link being provided with webs or plates which lap upon the adjacent links in such a way that when the wall-links are straightened and in extended position a smooth exterior is presented and when the folding wall-links are collapsed the close relation of the parts is maintained, so that a tubular frame which will support and properly distend the waterproof tube or outer covering with which the metal frame is covered is provided.

Various other novel details of construction will be touched upon in the description hereinafter in addition to the main features of the invention outlined above, and that which I consider as my invention will be defined in the appended claims.

In the drawings herewith I have illustrated one embodiment of my invention.

In said drawings, Figure 1 is a top view of the apparatus. Fig. 2 is a view of a section of the frame, the other sections being counterparts thereof, said view being partly in section to show the details of construction. Figs. 3 and 4 are vertical sectional and front elevation views, respectively, of one of the folding wall-links which connects the rings. Figs. 5 and 6 are similar views of one of the links which are provided with the webs or plates which overlie the other links of the wall. Fig. 7 is a horizontal sectional view to show the relative positions of links. Fig. 8 is a detail view of a portion of one of the rings which support the links. Fig. 9 is a detail perspective view of one of the hinge-blocks. Fig. 10 is a general view of the apparatus *in situ*. Fig. 11 is a view of the apparatus in collapsible condition upon a pier or wharf. Fig. 12 is a detail view of an armhole connection to which reference will be hereinafter made.

Referring to the drawings by numbers, like numbers indicating like parts in the several views, 1 indicates the supporting-ring of a collapsible tube-section, which is preferably made of two or more pieces halved together with dovetailed joints, as shown in Fig. 8, the several parts being fastened together by means of screws or bolts, as shown, the rings of each collapsible section, one at top and bottom, being provided with ladder-slots 101, which afford convenient means for the ascent and descent of the workmen within the caisson. Said ring is preferably made tapering in transverse section (see Figs. 2 and 8) from its outer to its inner edge in order that it may make a dovetail connection with the jaws 2 of the hinge-blocks 3, said ring 1 being cut away at some point, as 4, (see Fig. 8,) at its outer edge, so that the inclined jaws of the hinge-blocks 3 may be readily slipped upon the ring and then slid around the same circumferentially and in close relation to one another, as shown in Fig. 2. Each hinge-block 3 is provided with pintle-ears 5 on either side thereof, said pintle-ears being adapted to receive hinge-pintles 6, which are held between the ears 5 of adjacent hinge-blocks 3. The said pintles 6 support the ends of the connecting wall-links which join the rings of each

section, said links being made up of three members of relatively large cross-sectional area, so as to form a strong connection between the rings 1. The two end members 7 7 of the links are made tapering from their outer to their inner ends, as shown, to permit the inward folding of the series and being connected by a short intermediate member 8, which is hinged to the members 7 7, so as to break inwardly, but is provided with stops, so that the wall-links will be rigid against outward strains. Each alternate link member 7 carries an overlapping web or plate 9, which is preferably screwed or bolted thereto (see Fig. 7) and the side wings of which taper from their inner to their outer ends and extend over the adjacent link members, so as to form a close construction and a continuous smooth surface, so that no sharp corners or interstices occur which might abrade or tear the canvas or waterproof covering which envelops the frame and to which reference will be made. The intermediate link 8 carries a short web-section 10, which is provided at each end with thin hinged joint-covering plates or webs 11, which (see Fig. 5) slide beneath the undercut ends of the webs 9 when the sections are collapsed and serve to cover the link-joints when the sections are distended and the links are in extended position.

The construction above described gives a metallic tube of exceedingly close construction, the parts being closely fitted and assembled, one which is readily collapsible under pressure from the outside, but which is rigid and practically unbreakable under pressure from the inside, and both the outside and inside of the tube are free from projections, so that tearing of the outer waterproof covering on interference with the workmen inside the tube is obviated.

The tubular sections constructed as above described are put together in any suitable or desired length, lengths of ten feet having been found to be convenient in practical work, and each length is provided at top and bottom with a ring having an extended body 12, from which projects a horizontal rim or flange 13, the abutting flanges of the end sections of the adjacent lengths being connected by suitable screws 14, rubber packing-rings 15 being placed between the flanges 13 to give a tight joint. Each length of collapsible sections is provided with an exterior covering of canvas or waterproof material 15^a, this outer tube being secured by means of wires or straps 16, which encircle the rings 1, the hinge-blocks 3, which surround the rings, being provided with grooves 17 in their outer faces to form seats for the binding-wires. Each section length has exterior supporting-ropes 18, which are attached at either end to eyebolts 19, engaging ears or extensions 20 on the flanges 13, said bolts being locked in place by means of cotter-pins 21, as shown in Fig. 2. This arrangement of stay-ropes 18 relieves the col-

lapsible sections of which the several lengths are made of the strain of supporting the depending and submerged lengths of the caisson when they are fully extended, at the same time permitting the ready collapsing of the sections of the submerged lengths.

As shown in Fig. 10, the caisson is provided with a rigid non-collapsible turret 22, which is preferably interposed between two lengths of the caisson and suitably secured thereto, said turret having glazed sight-openings 23, projecting helmet-pieces 24, and flexible waterproof-covered arms 25 to permit inspection and manipulation of submerged objects. This turret 22 is preferably of larger diameter than the caisson proper, so as to give increased range of vision and greater freedom to the workmen. The arms 25, which are connected to the turret in the manner shown in Fig. 12, are provided with sliding gates 26, which may be thrown across the arm-opening in the turret and seal the same against the ingress of water and prevent flooding of the caisson in event of puncturing the waterproof covering of an arm during the work.

While the caisson constructed as above described may be supported in any suitable manner as the work may demand, I find that a convenient means of buoying the same is to provide an enlarged section 27, (see Figs. 10 and 11,) which is identical in construction with the collapsible sections described except that it is made enough larger than the tube-sections to form a floating chamber, from which the caisson depends, and as the said section 27 will not be collapsed while the caisson is in use I preferably provide brace-rods 28, (see Fig. 10,) which hold the links in extended position and the section 27 distended, as will be readily apparent, said rods 28 being detachable to permit folding of the buoyant section when the apparatus is not in use.

When the apparatus is to be used in submarine work, a number of the collapsible sections will be built up until a convenient length has been formed, and over this length the outer waterproof tube is drawn and secured, the bottom of the caisson of course being closed by a suitable bottom piece. A length of caisson will then be placed in the water and will be partially submerged. Additional sections and the inspection and work turret will then be built on, the caisson sinking slowly and in proportion to the weight until the desired depth has been reached. As the caisson sinks the sections will collapse under pressure of the water on the outer canvas tube; but it will be observed that such is the construction that this canvas or waterproof tube is at all times and at all points supported by the walls of the collapsible sections, so that puncturing-blows or tearing strains are not borne by the outer covering, but are taken up by the walls of the sections. This construction not only eliminates all danger of breaking of the outer tube and flooding of the caisson, but permits

the use of lighter waterproof tubing and materially prolongs the life of the same. On the top of the caisson I then place the buoyant chamber and moor the same, and the apparatus is then in shape for any submarine operations desired.

While I have shown and described a particular construction and that the best now known to me, it is obvious that numerous changes within the range of mechanical skill may be made without departing from the spirit of my invention, and I do not, therefore, wish to be understood as limiting myself to any of the details of construction shown and described except so far as I am limited by the terms of the appended claims.

Having thus described my invention, I claim—

1. An apparatus for submarine work having continuous collapsible inner walls and a flexible waterproof outer covering.

2. An apparatus for submarine work formed of a series of sections having collapsible walls and a flexible waterproof outer covering.

3. An apparatus for submarine work formed of a series of sections having collapsible walls and a continuous flexible waterproof tube enveloping said sections.

4. An apparatus for submarine work having inwardly-collapsible inner walls and a flexible waterproof outer covering.

5. An apparatus for submarine work formed of a series of sections having inwardly-collapsible walls and a continuous flexible waterproof tube enveloping said sections.

6. The combination in an apparatus for submarine work, of a series of sections having inwardly-collapsible walls, an outer tube of flexible waterproof material, and stay-ropes connecting the end sections of the said series.

7. An apparatus for submarine work comprising a tubular section and a rigid turret or work-chamber of larger diameter secured thereto.

8. An apparatus for submarine work comprising a collapsible section and a rigid turret or work-chamber of larger diameter secured thereto.

9. An apparatus for submarine work comprising two collapsible sections and an interposed rigid turret or work-chamber of larger diameter secured thereto.

10. An apparatus for submarine work comprising collapsible sections, a rigid turret or work-chamber of larger diameter interposed between the sections, and a buoyant chamber of relatively large diameter secured to the top of the upper sections of the apparatus.

11. An apparatus for submarine work comprising collapsible sections, a rigid turret or work-chamber of larger diameter interposed between the sections, a collapsible buoyant chamber of relatively large diameter secured to the top of the upper sections of the apparatus, and means for holding said collapsible chamber normally distended.

12. In an apparatus of the class described, a section having a wall formed of closely-arranged collapsible links.

13. In an apparatus of the class described, a section having a wall formed of closely-arranged, overlapping collapsible links.

14. In an apparatus of the class described, a section having a wall formed of overlapping inwardly-foldable links.

15. In an apparatus of the class described, a section having a wall formed of closely-arranged, overlapping, inwardly-collapsible links; said links being rigid against outward strains.

16. In an apparatus of the class described, a section comprising end rings, hinge-blocks carried thereby, and collapsible wall-links hinged to said blocks.

17. In an apparatus of the class described, a section comprising end rings, detachable hinge-blocks carried thereby, and collapsible wall-links hinged to said blocks, each alternate link being provided with overlapping wings or webs.

18. In an apparatus of the class described, a section comprising end rings tapering in cross-section, hinge-blocks provided with dovetailed jaws to engage the said tapering end rings, and collapsible wall-links hinged to said blocks.

19. A section-ring for collapsible caisson-sections the body of which is tapering in cross-section and is provided with a cut-away portion on its outer edge to receive the undercut or dovetailed hinge-block jaws.

20. A section-ring for collapsible caisson-sections having ladder-slots formed in the body thereof.

21. A wall-link for collapsible caisson-sections having end members, and an intermediate connecting member.

22. A wall-link for collapsible caisson-sections having end members, an intermediate connecting member, and means for locking said link against collapsing in one direction.

23. A wall-link for collapsible caisson-sections having end members, an intermediate connecting member, and stops on said link members to prevent collapsing of the link in one direction.

24. A wall-link for collapsible caisson-sections having tapering end members and an intermediate connecting member.

25. A wall-link for collapsible caisson-sections having end members, web extensions carried thereby, an intermediate connecting member, and web extensions carried by said intermediate member.

26. A wall-link for collapsible caisson-sections having end members provided with web extensions the inner ends of which are undercut, intermediate connecting members having web extensions, and hinged webs carried by said intermediate member and arranged to slide beneath the undercut ends of the web extensions on the end members.

27. A turret for submarine apparatus having flexible arm extensions, and a gate to close the arm-aperture in the turret-wall.

28. In an apparatus of the character described a collapsible section comprising two end members, a plurality of foldable links joined at their opposite ends respectively to said end members, and a waterproof jacket inclosing the section, said links constituting
10 means for supporting the jacket from within.

29. In an apparatus of the character described, a collapsible section comprising two end members, a plurality of tapering inwardly-foldable links having a connection
15 with each other at their narrower ends and joined at their other ends respectively to said end members, and a waterproof jacket in-

closing the section, said links constituting means for supporting the jacket from within between the end members. 20

30. In an apparatus of the character described a collapsible section, comprising two end members, foldable wall-links hinged at their opposite ends respectively to said end members, and means for rendering the sides
25 of the section proof against the entrance of fluid.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES WILLIAMSON.

Witnesses:

JOHN T. WADE,
R. P. VINCENT.